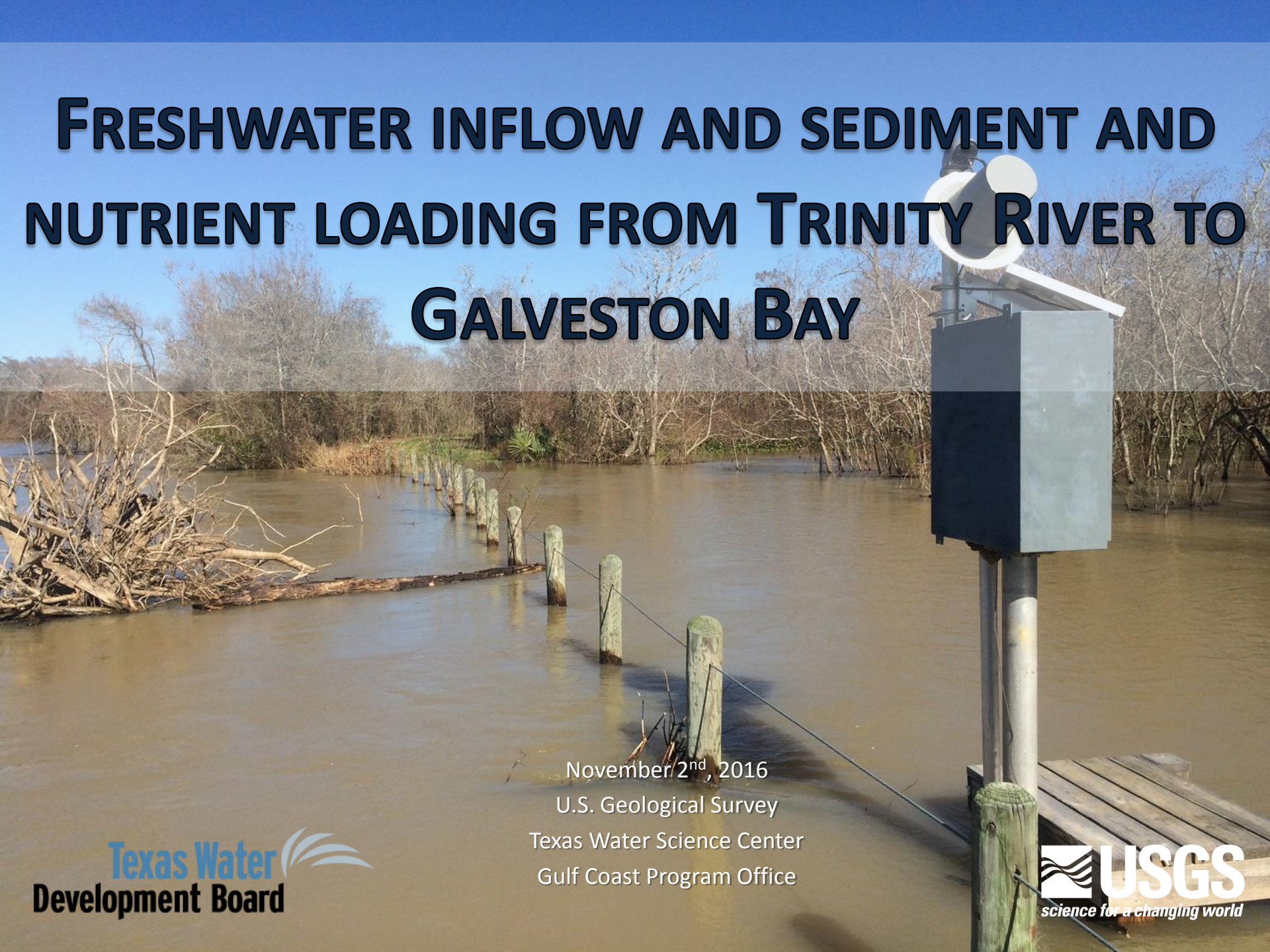
Freshwater inflow and sediment and nutrient loading from Trinity River to Galveston Bay



November 2nd, 2016

U.S. Geological Survey
Texas Water Science Center
Gulf Coast Program Office

Texas Water Development Board

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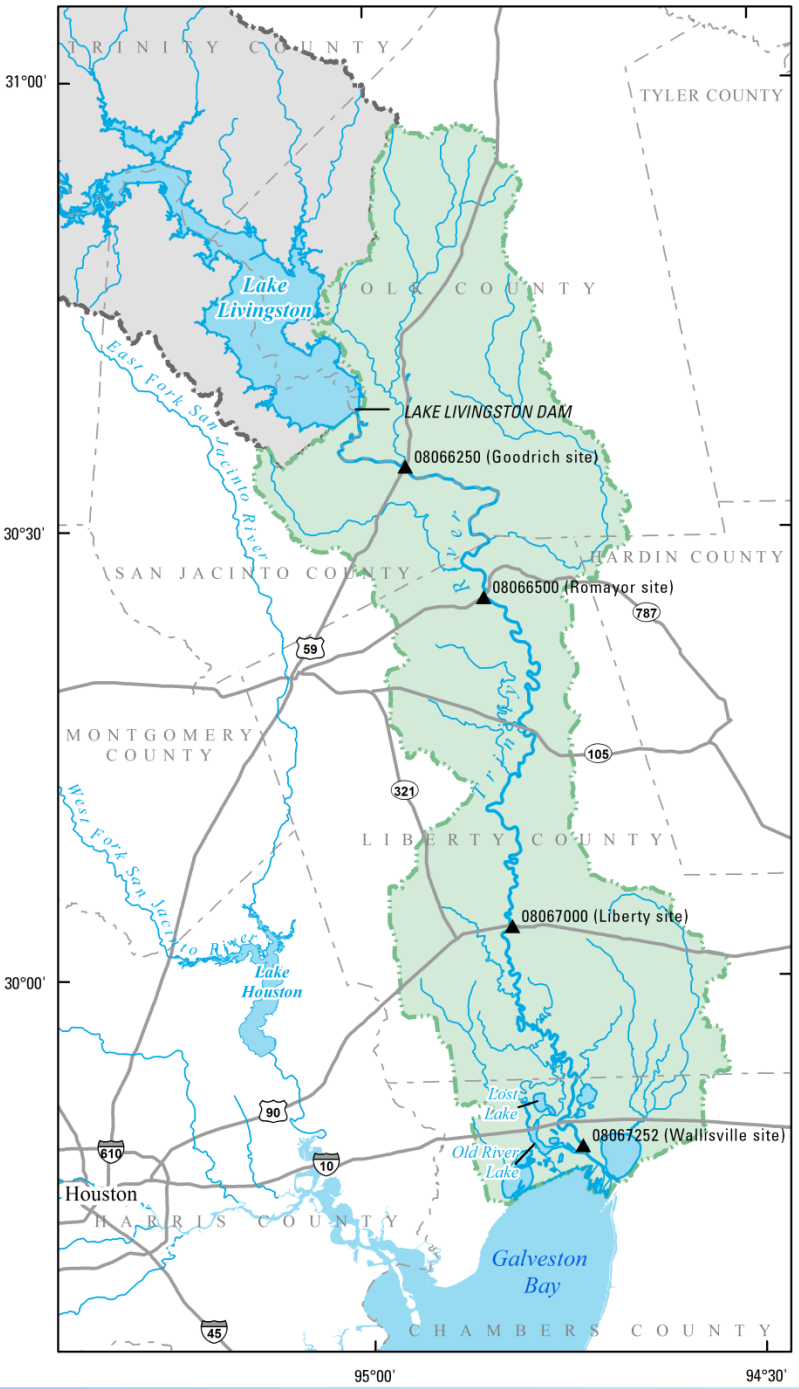

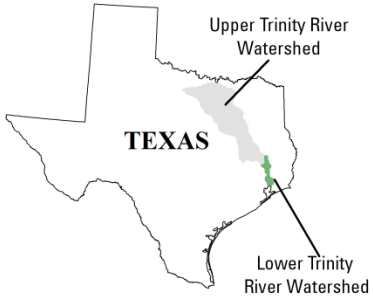

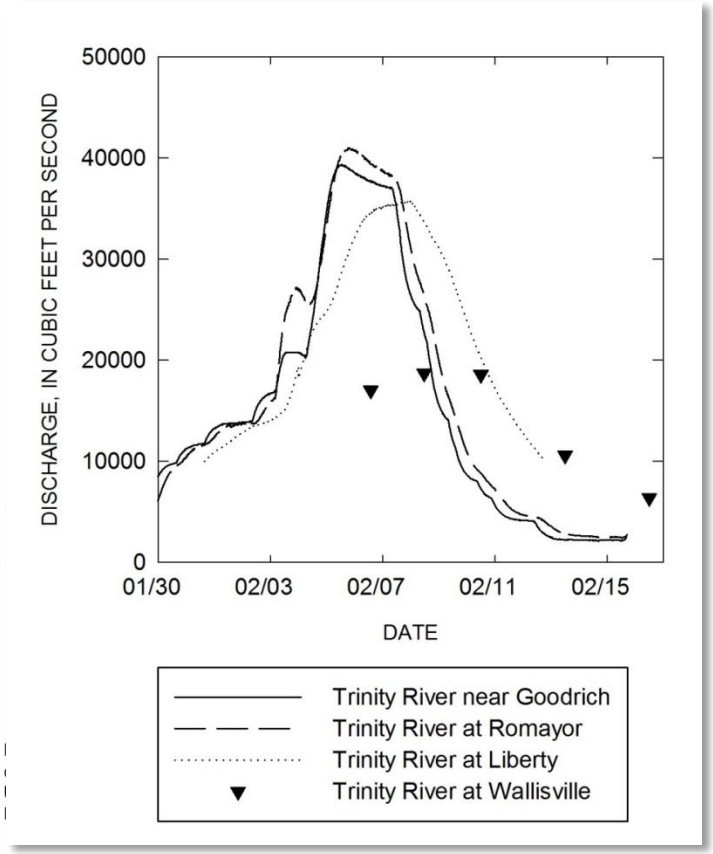

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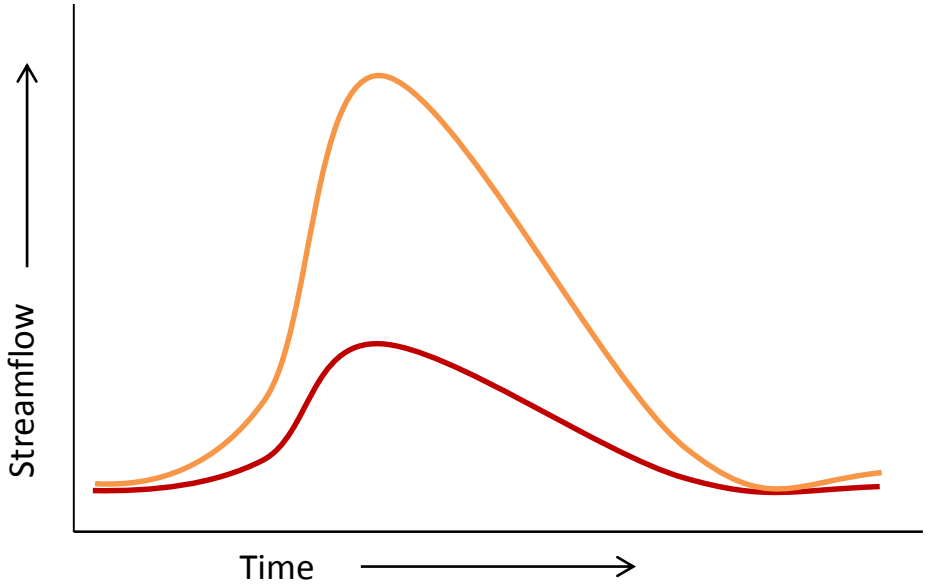
Wallisville streamgage
Old River
Lake
Galveston
Bay
Google earth

Scenario #1



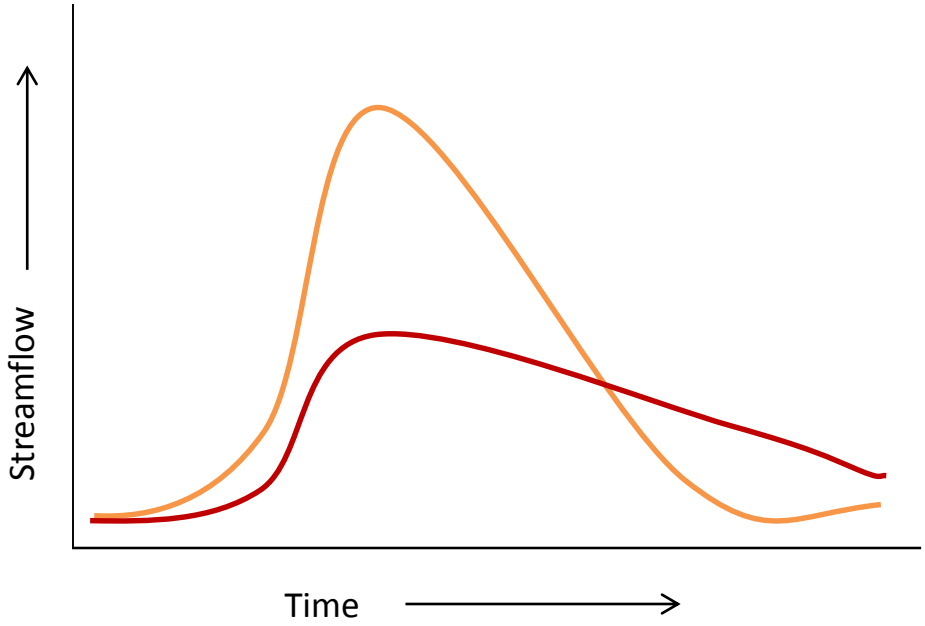
EXPLANATION

- Upstream streamgage
- Wallisville streamgage

Indicates water is potentially diverted into wetlands and flowing to Galveston Bay through Old River and delta.

Indicates water may flow into wetlands and released into main channel of Trinity River when flows are decreasing.

Scenario #2



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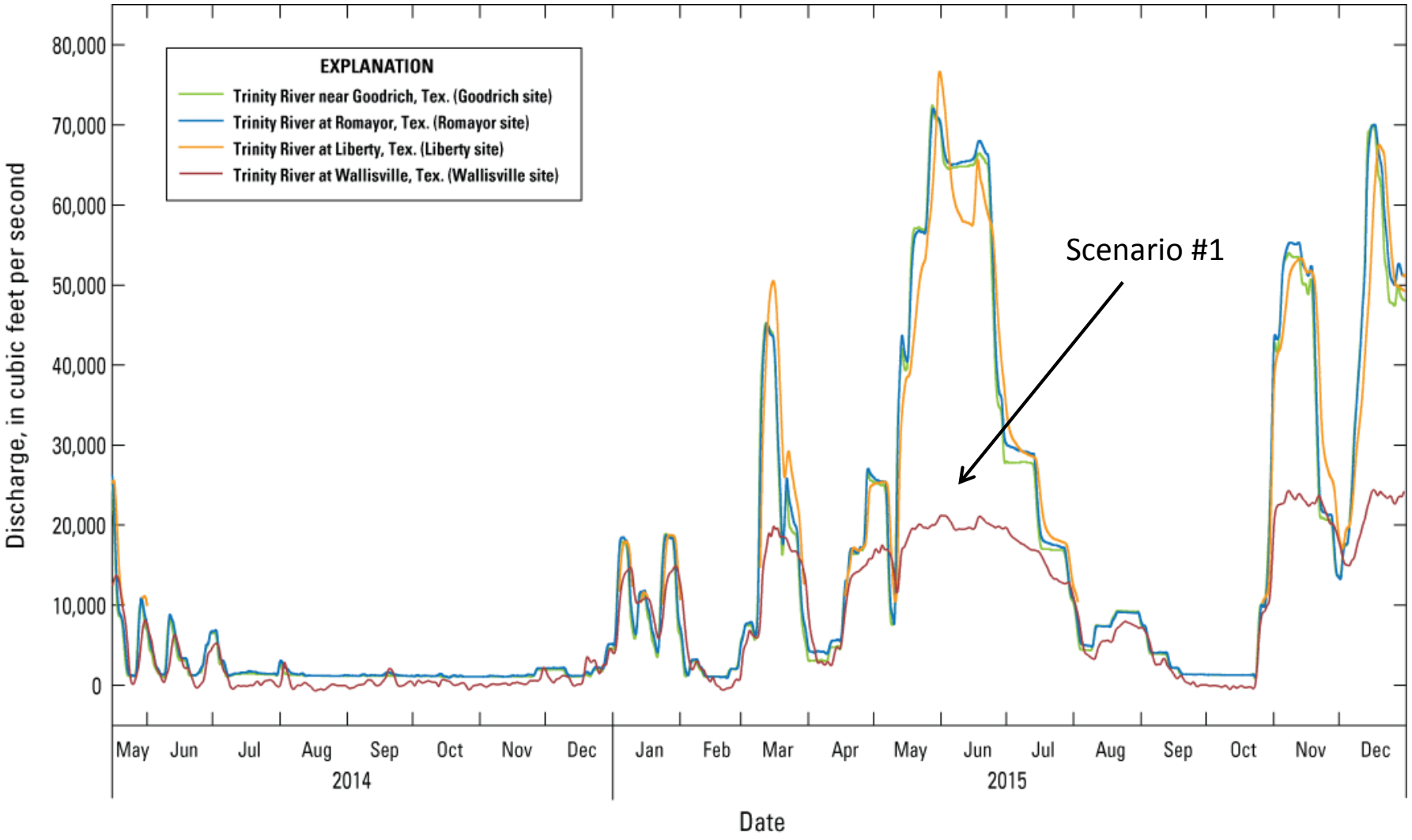

Highest streamflow measured at Wallisville site: 24,000 ft^3/s

28 to 82 percent of the flow measured upstream

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Wallisville streamgage
Old River
Lake
Galveston
Bay
Google earth

PROJECT TASKS

Main task: *Analysis of streamflow and nutrient and sediment concentrations in the lower Trinity River watershed*

1. Operation and maintenance of index-velocity gage at Trinity River at Wallisville, Tex. and periodic water-quality sample collection.
2. Streamflow measurements and water-quality sample collection at Old River and Wallisville site during high flows.
3. Examine streamflow and water-quality from Lake Livingston to the lower parts of the watershed.

Task 1: *Periodic water-quality sample collection and operation and maintenance of index-velocity gage at USGS station 08067252 Trinity River at Wallisville, Texas.*

Water-Quality

- Nutrients
  - Ammonia
  - Nitrate
  - Nitrite
  - Total nitrogen
  - Total phosphorus
  - Orthophosphate
  - Total organic carbon
  - Dissolved organic carbon
- Water-quality properties
  - Temperature
  - pH
  - Dissolved oxygen concentration
  - Turbidity
  - Specific conductance
- Suspended-sediment

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Acoustic Surrogate for Suspended-Sediment

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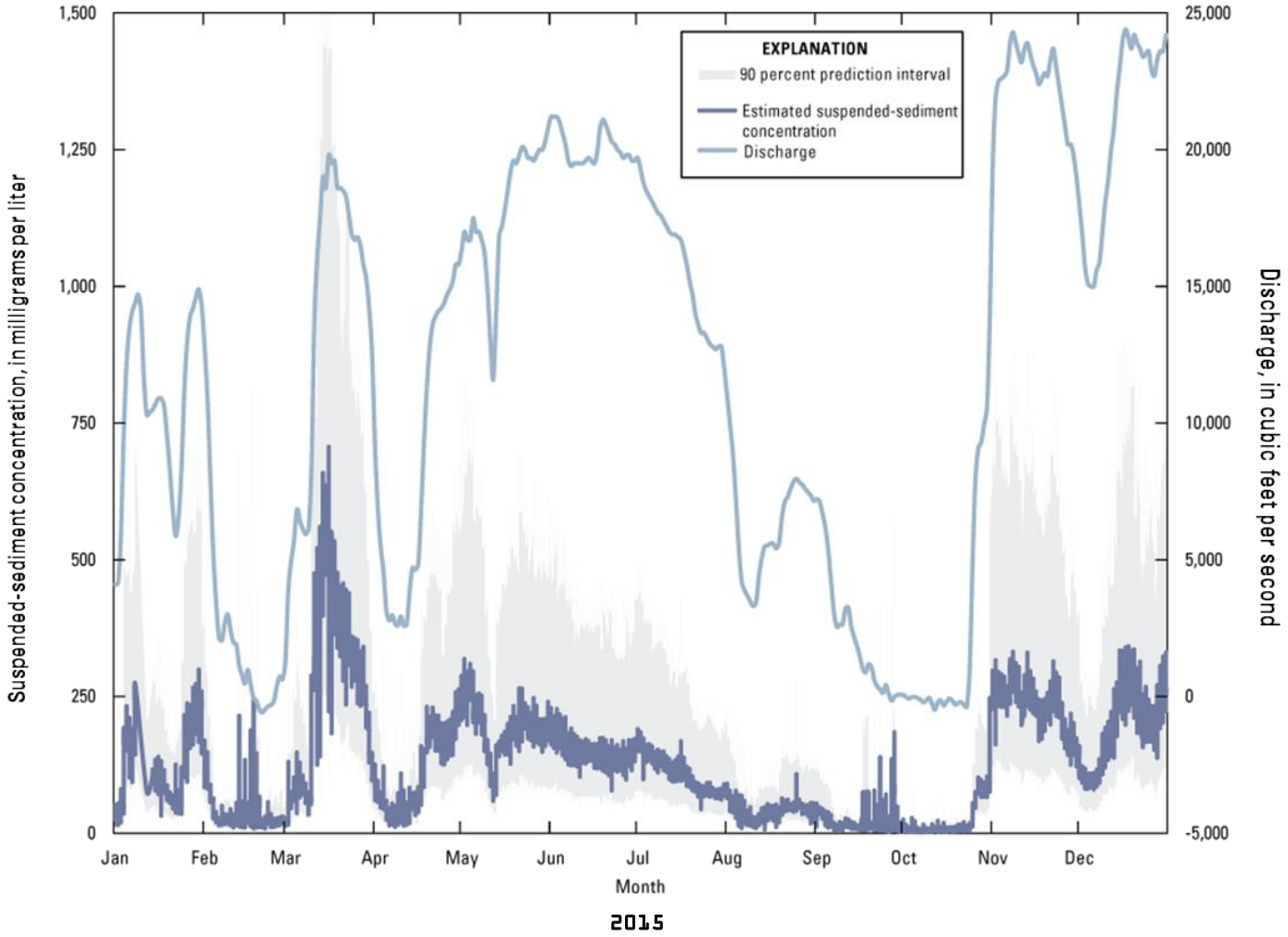
Acoustic Surrogate for Suspended-Sediment



Estimates of suspended-sediment concentrations every 15-minutes.

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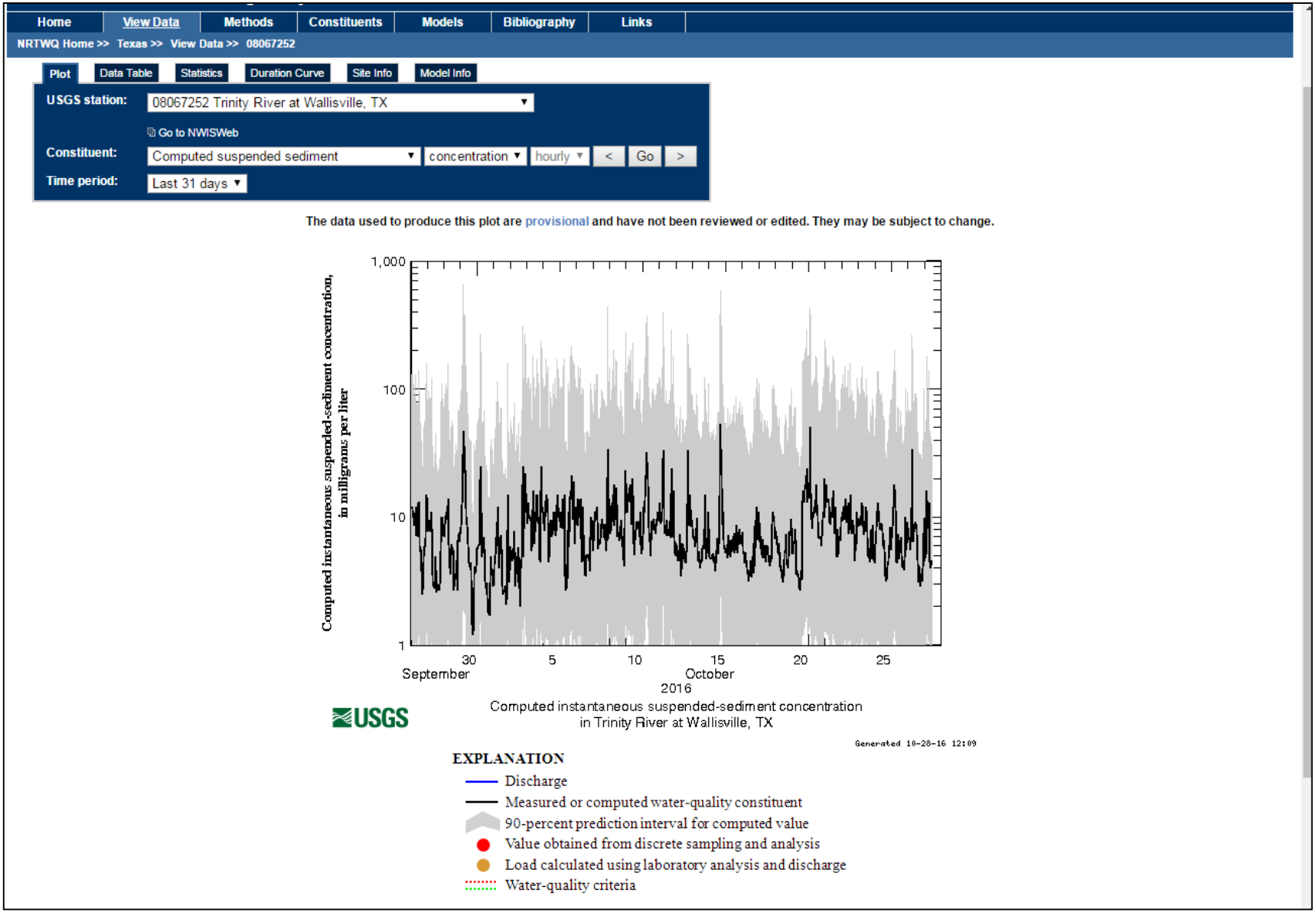

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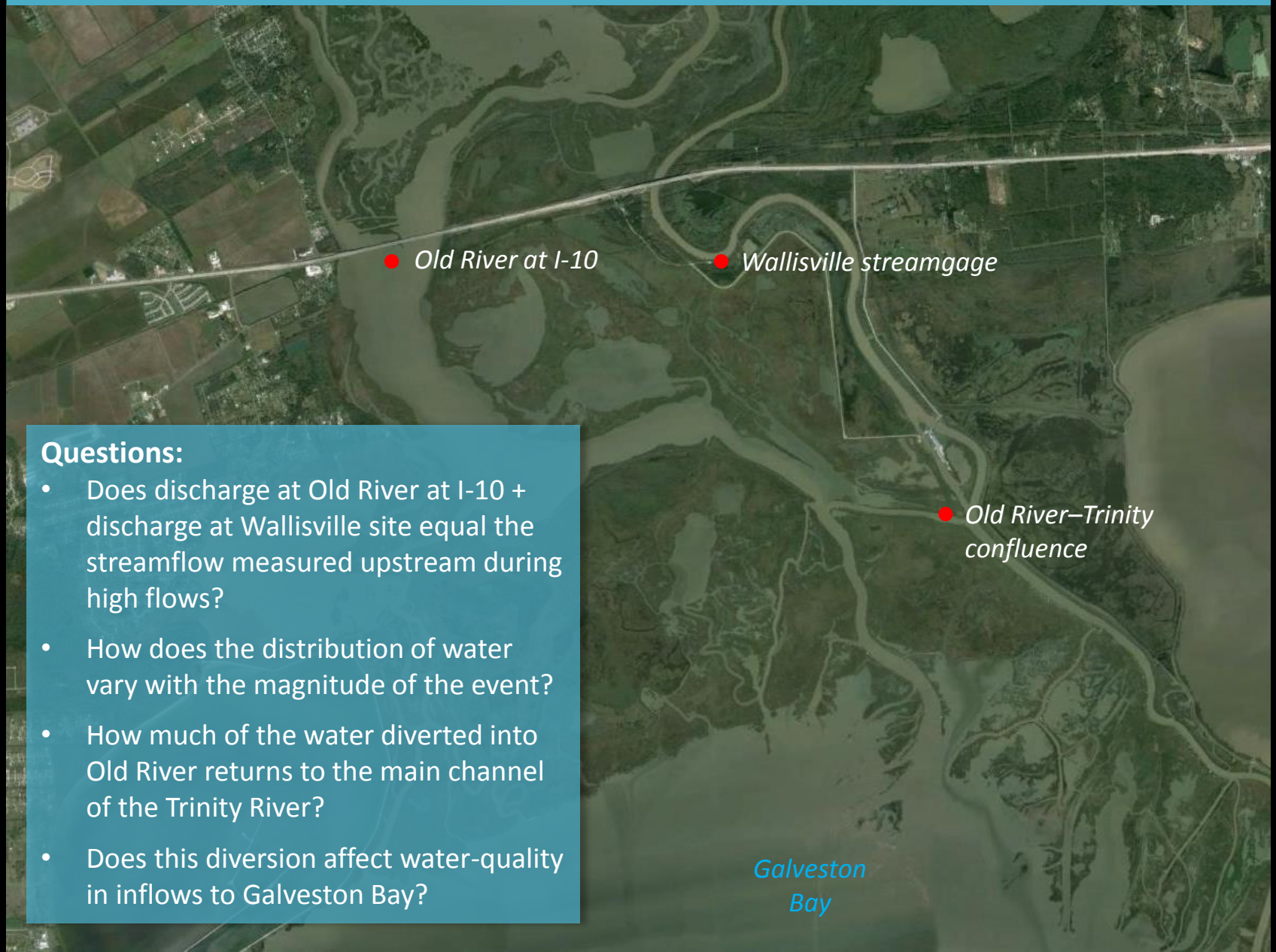
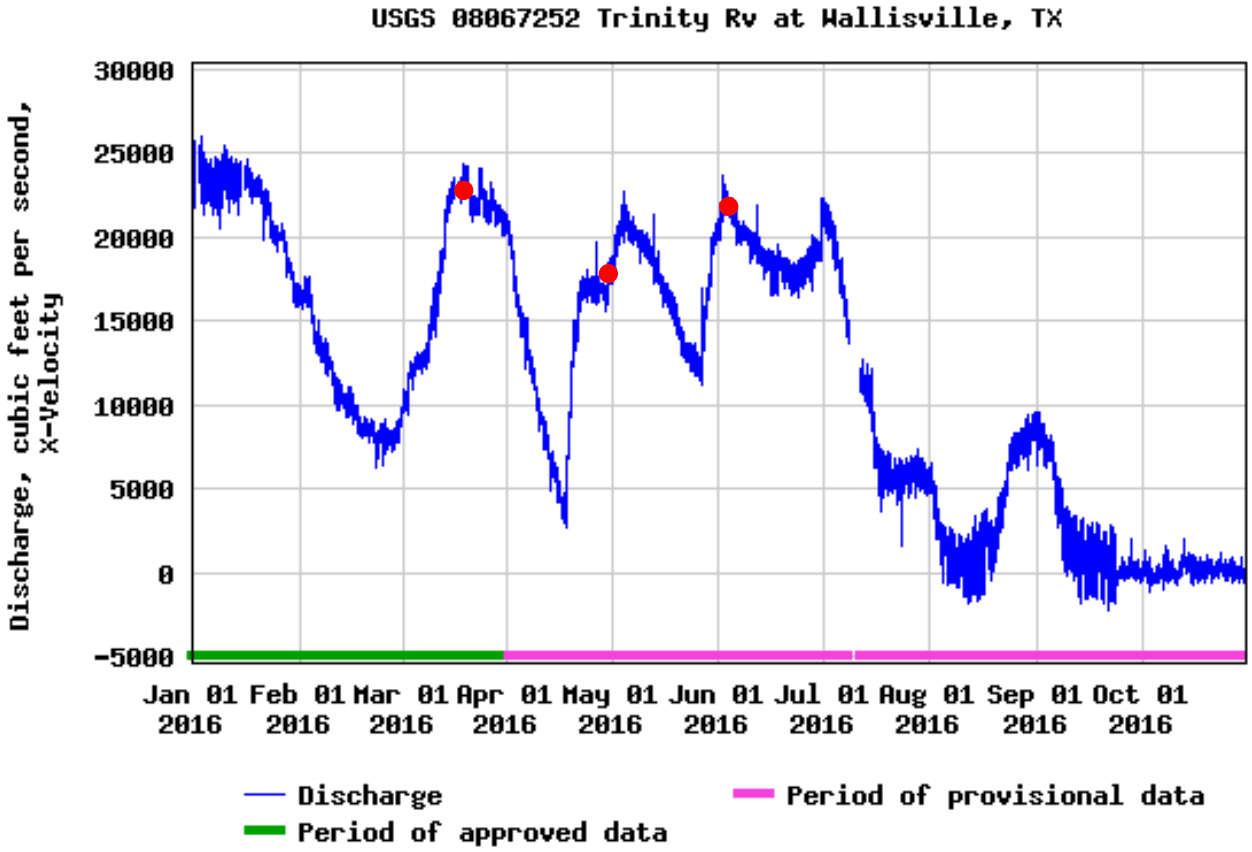
National Real-Time Water Quality:
https://nrtwq.usgs.gov/

Task 2: *Streamflow measurements and water-quality sample collection at Old River and Wallisville site during periods of high flow*



Questions:

- Does discharge at Old River at I-10 + discharge at Wallisville site equal the streamflow measured upstream during high flows?
- How does the distribution of water vary with the magnitude of the event?
- How much of the water diverted into Old River returns to the main channel of the Trinity River?
- Does this diversion affect water-quality in inflows to Galveston Bay?



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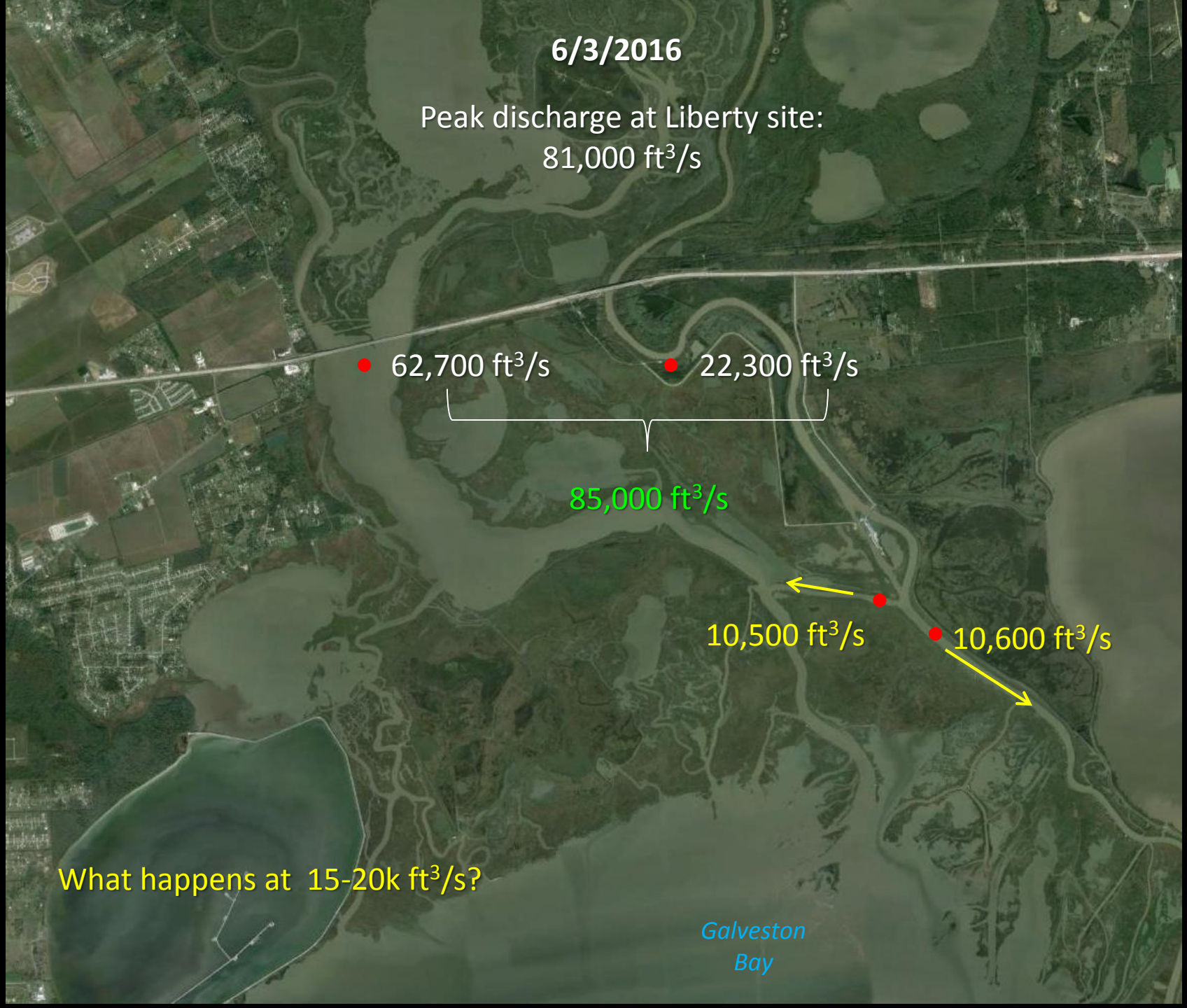
3/17/2016
Peak discharge at Liberty site:
52,000 ft3/s
34,800 ft3/s
22,700 ft3/s
57,500 ft3/s
13,200 ft3/s
Galveston
Bay


4/26/2016
Peak discharge at Liberty site:
32,000 ft³/s
7,360 ft³/s
17,200 ft³/s
24,600 ft³/s
11,300 ft³/s
5,200 ft³/s
Galveston
Bay


6/3/2016
Peak discharge at Liberty site:
81,000 ft³/s
62,700 ft³/s
22,300 ft³/s
85,000 ft³/s
10,500 ft³/s
10,600 ft³/s
What happens at 15-20k ft³/s?
Galveston
Bay

Streamflow Summary

Streamflow (in cubic feet per second) measured at:

Date	Trinity River at Liberty	Trinity River at Wallisville	Old River Lake	Wallisville + Old River	Difference in streamflow
6/10/2015	60,000	21,600	44,300	65,900	5,900
3/17/2016	52,000	22,700	34,800	57,500	5,510
4/26/2016	32,000	17,200	7,360	24,600	-7,440
6/3/2016	81,000	22,300	62,700	85,000	4,950

Storage in wetlands?

Timing of sample collection and previous conditions matter

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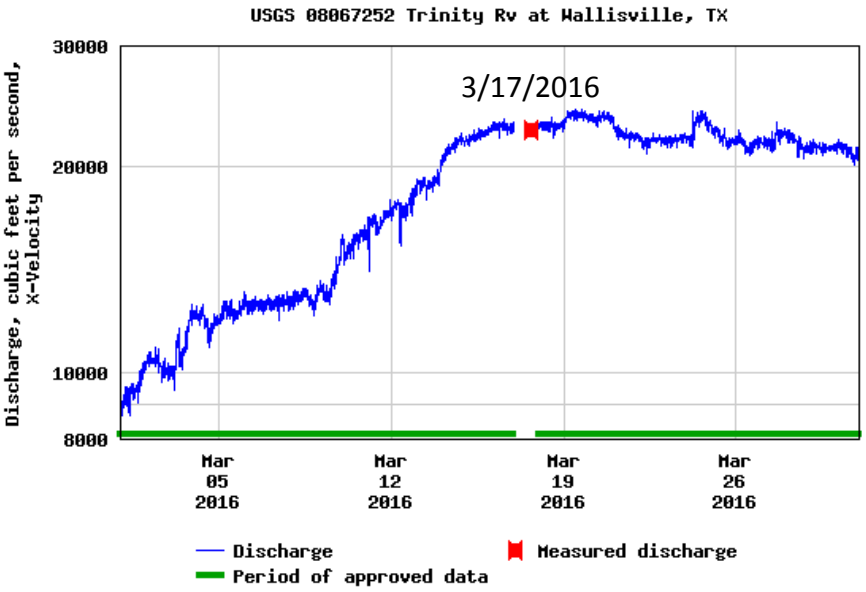
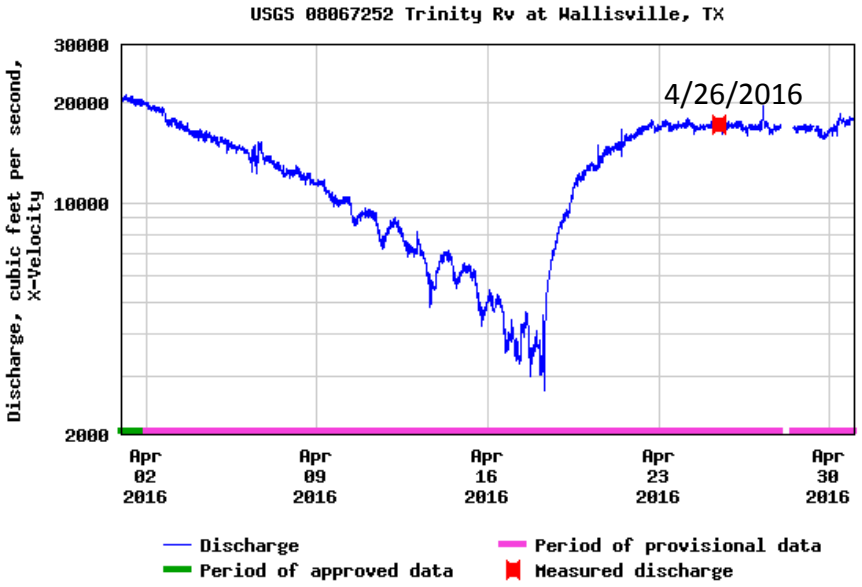
STREAMFLOW SUMMARY



Peak flow at Liberty site: 52,000 ft^3/s
Streamflow measured at Old River and Wallisville site add up.

Peak flow at Liberty site: 32,000 ft^3/s
Streamflow measured at Old River and Wallisville site do not add up.



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What does this mean for water-quality?

SELECTED NUTRIENTS

	Total Nitrogen (mg/L)		***Nitrate + Nitrite (mg/L as N)***		***Total Phosphorus (mg/L)***	
Date	*Old River*	*Wallisville*	*Old River*	*Wallisville*	*Old River*	*Wallisville*
3/17/2016	1.19	1.25	0.663	0.650	0.122	0.129
4/25/2016	1.17	1.16	0.387	0.437	0.142	0.145
6/3/2016	0.87	0.82	0.302	0.230	0.120	0.131

*Preliminary data, subject to revision

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SUSPENDED-SEDIMENT

	Suspended-sediment concentration (mg/L)		Percentage of silt and clay sediment particles	
Date	*Old River*	*Wallisville*	*Old River*	*Wallisville*
3/17/2016	43	145	99	60
4/25/2016	52	158	100	67
6/3/2016	41	134	100	67

*Preliminary data, subject to revision

- Suspended-sediment concentrations and size distribution different between Old River and Wallisville site.
- Suspended-sediment concentrations measured at Wallisville, Liberty, and Romayor sites may not be representative of inflow to bay.

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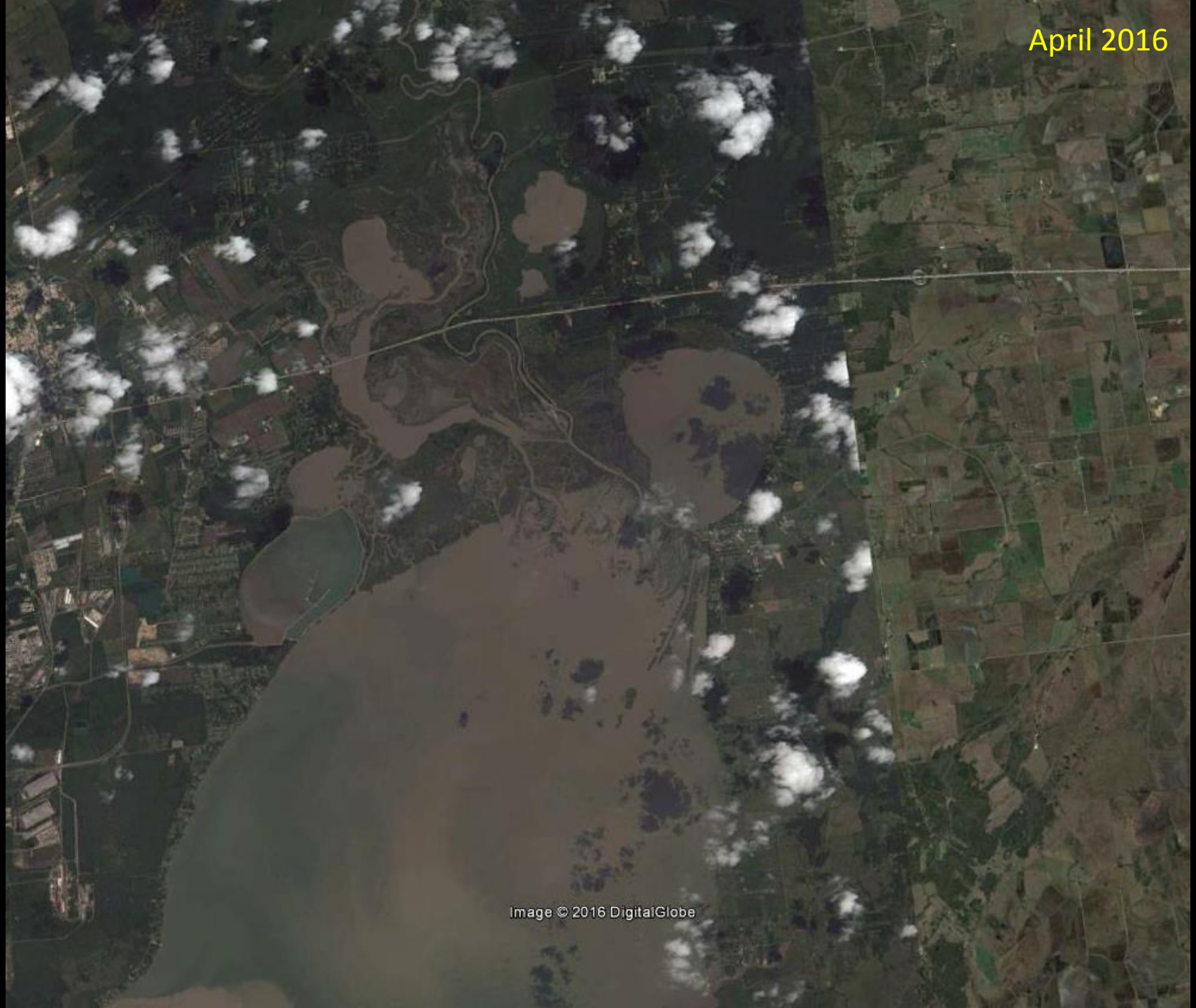
April 2016
Image © 2016 DigitalGlobe

SUSPENDED-SEDIMENT

Liberty site		Wallisville site	
Date	*Suspended-sediment concentration (mg/L)*	*Date*	*Suspended-sediment concentration (mg/L)*
3/16/2016	200	3/17/2016	145
4/20/2016	438	4/25/2016	158
6/1/2016	350	6/3/2016	134

*Preliminary data, subject to revision

- Floodplain or channel retention of suspended-sediment?
- Continuous suspended-sediment record provides information on peak suspended-sediment concentration at Wallisville site

Task 3: Examine streamflow and water-quality from Lake Livingston to the lower portions of the watershed.

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Old River at I-10
Wallisville streamgage
Galveston
Bay

SUMMARY

- Flow in the lower Trinity River watershed does not follow the expected pattern:
  - A large part of the water volume (during high-flow events) enters Galveston Bay through Old River, including a portion of the volume measured at Wallisville site.

- Suspended-sediment transport to Galveston Bay may be affected by these flow patterns.
  - We need more data to statistically determine if this is the case.

What's Next?

- Continue O&M of index-velocity streamgage and suspended-sediment rating at Wallisville site.
- Collect water-quality samples and conduct discharge measurements:
  - at target flows of 15-20k ft^3/s and 35-50k ft^3/s and
  - during events with varying antecedent conditions.
- Collect water-quality samples at additional locations:
  - mixing point between Old River and Wallisville site
  - downstream from saltwater barrier
- Examine spatial trends in water-quality in lower Trinity River watershed.

U.S. Geological Survey
Texas Water Science Center
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Zulimar Lucena
zlucena@usgs.gov

Michael T. Lee
mtlee@usgs.gov